Thesis/
Reports
Schweitzer,
D. L.

CONCEPTUAL ISSUES AND IMPLICATION IN DEFINING RECREATIONAL BENEFITS OF WILDLIFE AND FISHERIES MANAGEMENT IN THE NATIONAL FOREST SYSTEM

Dennis L. Schweitzer

CONCEPTUAL ISSUES AND IMPLICATIONS IN DEFINING RECREATIONAL BENEFITS OF WILDLIFE AND FISHERIES MANAGEMENT IN THE NATIONAL FOREST SYSTEM

LIBRARY COPY
ROCKY MTN. FOREST & RANGE
EXPERIMENT STATION

Dennis L. Schweitzer
Rocky Mountain Forest and Range Experiment Station
Fort Collins, Colorado

March 18, 1981

A Report to

Director of Wildlife and Fisheries Management
Director of Resources Planning and Assessment
USDA Forest Service

TABLE OF CONTENTS

Topic	Page
Preface	i
Introduction	1
Conceptual and Methodological Basis for Valuation	2
Conceptual Basis	2
Definition of "society"	3
Summary	3
Measuring Benefits for Efficiency Analysis	4
Methodological Basis	5
Applied Valuation	6
Quality and Quantity Changes	6
Definition of Value Per Unit	7
Possibility of over-estimation	8
Possibility of introducing significant errors	10
Netting-out Loss of Benefits	12
Conceptual framework	13
Significance of failure to net out benefits	14
Summary and Conclusions	19
Appendix: WL/F Management Rationalization	21

PREFACE

In February, 1981 John Fedkiew, USDA, requested that a conceptual paper focused on the rationalization of WL/F-dependent recreational benefits be prepared. The request grew out of questions about, or dissatisfactions with, procedures that had been used in developing base data to support the RPA-80 Program and concern for the data that would be developed to support the RPA-85 Program. This paper is the response to that request.

CONCEPTUAL ISSUES AND IMPLICATIONS IN DEFINING RECREATIONAL BENEFITS OF WILDLIFE AND FISHERIES MANAGEMENT IN THE NATIONAL FOREST SYSTEM

INTRODUCTION

The general mission of the National Forest System is to manage the resources on about 187 million acres of lands and waters in the manner that will most contribute to the welfare of the American people in perpetuity. The Wildlife and Fisheries Management Staff has the more specific mission of ensuring that those particular resources are so managed.

While final decisions are the prerogative of the Administration and Congress, the WL/F staff has the technical responsibility to make recommendations and to define implications to society. The underlying process of rationalization requires that management objectives be defined, that technical possibilities for achieving those objectives be formulated, and that the costs of initiating specific management programs be contrasted with postulated benefits.

The major purposes of this report are to define the conceptual basis for defining recreational benefits attributable to WL/F management in NFS, to contrast that ideal with current practices, and to discuss the likely significance of any deviations. An appendix is included to provide the context of program rationalization for the discussion of benefit identification.

Conceptual and Methodological Basis for Valuation

Conceptual Basis

All federal activities are avowedly rationalized on the basis of increasing society's welfare. Forest Service legislation explicitly defines this rationalization to include consideration of the long-run. Therefore, measures of benefits must measure the degree of enhancement of society's welfare in the long run due to some activity.

The National Environmetal Policy Act and other legislation make clear that enhancement in long-run welfare can only be measured by utilizing several kinds of indicators that are often subsumed in analytical models focused on economic efficiency, social impacts and ecological or environmental effects.

Because of the relative state-of-the-arts of these alternative models, the conventional analytical approach is to directly conduct economic efficiency analyses, which explicitly or implicitly include an objective function posited to be consistent with the fundamental welfare function, and to report consequent changes in other kinds of indicators. NFMA and its implementing Regulations clearly recognize that there is an imperfect fit between current analytical objective functions and the desired welfare function. That is why planning decisions must consider impacts and effects and public preferences as well as efficiency in the final decision process.

Definition of "society". -- The obvious definition of the society that must be benefitted by federal programs is "the nation's population." Net national welfare must be enhanced. That is why, for example, the Water Resources Council proposes that both national and regional economic accounts be utilized in evaluating the contribution to welfare of any proposal. The national account "nets out" local benefits achieved at the expense of loss of benefits in other areas. By this criterion, net gains in American society's welfare are to be measured.

In contrast, NFMA requires that the most cost-effective set of activities be employed that will reach Forest objectives, where:

"Objectives assigned to each Forest will be evaluated to assure that they are compatible with local supply and demand . . ." (Regs, 219.3,b,3)

That is, the measure of benefit is enhancement of local welfare.

Only in the unlikely event that there are never losses of benefits in one area in response to new opportunities on a Forest located elsewhere can these criteria be consistent. Inconsistencies imply problems in reconciling the agency's integrated planning and budgeting systems.

Summary. -- The present points are relevant to the issue of indentifying benefits:

1. Benefits are defined to be increases in society's welfare.
2. Society is defined inconsistently.
3. Measuring changes in society's welfare requires the simultaneous use of several different kinds of indicators.

Measuring Benefits for Efficiency Analysis

Because available resources of land and tax dollars (i.e. labor and capital) are scarce, it is necessary to determine whether a particular expenditure would increase welfare "enough", where "enough" is defined by some absolute minimum defined through comparisons with alternative possibilities. This requires the application of logically consistent (i.e. theoretically supportable) manipulation techniques to a consistently defined data set. Because welfare changes cannot be totally measured by any one indicator, efficiency analyses must yield both analytical (dollar costs vs. dollar benefits) and descriptive (effects on other indicators of welfare) results.

Given certain theoretically supportable assumptions,[1/] simultaneously derived (economic) demand and supply curves provide an appropriate basis for efficiency evaluation. In particular, demand curves provide a basis for expressing the economic value of benefits. By definition, the demand curves for all products (whether marketed or not) are constructed in a consistent fashion and, therefore, can be used to provide consistent estimates of the gains in welfare due to initiation of all management activities.

1/ These are (1) social welfare is determined by some aggregation of levels of satisfaction of individuals, and (2) the current distribution of income is an acceptable means of performing this aggregation.

Given further assumptions, which are consistent with theoretical expectations, demand curves can be approximated for individual recreational experiences without simultaneously defining supply curves.[2/] Finally, the application of available empirical techniques require the usual assumptions that compiled data in fact measure what theoretical constructs say should be measured.[3/]

Methodological Basis

Either through an observational (travel cost) or questionnaire (contingent survey, bidding game) technique,[4/] a demand curve for the recreational opportunities in a given area can be developed. Such a curve summarizes the quantities of opportunities that would be consumed or utilized at varying costs to the recreationists. The sum of the differences between the prices individuals would be willing to pay and the prices

---

2/ Simultaneous solution requires solving equations of the form:

$$Q_d = x + yP \text{ and}$$

$$Q_s = a + bP$$

Assuming that $P = \bar{P}$ (that is, that price is independent of quantity or that each individual faces a horizontal supply curve) permits solution of Q_d without solution of Q_s. To define Q_d for just one experience (e.g. hunting) requires that there be independence among demands for different experiences (zero cross-price terms); the degree of reality of this assumption depends upon the breadth of the definition of "experience" (that is why the "hunting experience" package includes non-hunting activities).

3/ Current techniques require assuming that travel cost or bidding game methods yield "good enough" estimates of $\bar{P}$; empirical validation studies suggest that results are generally acceptable.

4/ Travel cost techniques are preferred to assess site-specific opportunities; bidding games are somewhat more workable in assessing a variety of opportunities spread over a large area, such as a National Forest. Because travel cost techniques are based on observations of what people do rather than on what people say they would do, they are generally regarded as superior.

they do pay is the (gross) site rent.[5/] If a fence were constructed on the boundary of the area containing the opportunity for recreation, this sum could be extracted as entrance fees, and is the appropriate measure of the economic value of recreational benefits.

Applied Valuation

Quality and Quantity Changes

Benefits result from WL/F recreation-oriented management activities if the after-management hypothetical site rent is greater than the before-management site rent. There are two basic ways such rents can be increased on the National Forests:

1. By increasing the number of RVD's. -- If opportunities are supply-constrained rather than price-constrained, an increase in available opportunities will lead to more visits by each recreationist and/or by more recreationists.
2. By increasing the willingness-to-pay for each RVD. -- Improvements in the quality of opportunities will increase the hypothetical fee that could be extracted from each visit.

In fact, most increases in either quantity or quality are likely to lead to increases in site rent due to both more RVD's and an increased willingness to pay for each RVD, at least temporarily. Because an increase in quantity is likely to reduce congestion, quality increases. When an increase in quality implies a higher probability of success, more recreationists may be attracted. It is only after some new equilibrium between users and opportunities has been achieved that the net effects can be determined.

5/ It is assumed that state license fees attributable to NFS recreation and NFS on-site camping fees (where camping is part of the recreation package under consideration) can be neglected; in most instances, the introduced error is unlikely to be significant for WL/F-dependent recreation.

In terms of demand curves, any increase in quantity of opportunities of constant quality (when price is not the limiting factor) will lead to movement along the (downward-sloping) demand curve, increasing site rent. In contrast, at some point improvements in quality redefine the opportunity of interest and the demand curve shifts to the right (i.e. users will pay more per visit), further increasing site rent, and may have a change in slope (i.e. become less elastic), adding a third increment of site rent.

In current LMP valuation, only the change in quantity of recreationists is credited; changes in quality of recreation are ignored. Since benefits are the difference between before-management and after-management site rents, they must be generally underestimated under current procedures, unless the values per RVD currently in use are too high or deductions are required to net out loss of benefits elsewhere.

Definition of Value Per Unit

The Water Resources Council explicitly supports the use of travel cost (first choice) and bidding game (second choice) techniques as theoretically and methodologically tenable methods of defining demand curves for recreation.[6/] However, the Council also recognizes that completed studies encompass

---

6/ It is not clear that current methodologies retain their theoretical tenability when applied to a vast array of recreational opportunities spread over very large areas such as those found on National Forests. WRC procedures are site specific. To apply the strictly defined travel cost methodology without introducing a wide range of new assumptions would require simultaneous evalutions to account for substitutabilities; no one has ever succeeded in dealing with more than six sites at one time. Broad averaging of empirically derived site-specific or small-area specific estimates may well lead to equally accurate results.

only a small portion of the lands and waters administered by federal agencies. Therefore, they spell-out the third-best approach of defining unit values based on judgement as an "acceptable", if crude, substitute.

NFS has had no choice but to relay on this judgement approach. However, there is no evidence that such reliance leads either to over-estimates of WL/F recreation benefits or to significant errors in LMP or functional budget analyses. Indeed, there are logical reasons to believe otherwise.

Possibility of over-estimation. -- The estimates of unit values used in RPA-80 were based upon a nation-wide review of all available travel cost and bidding game (and other contingent value) studies. Because only a small fraction of the National Forest System was included in all these studies combined, study results were broadly averaged by major activities, with the recognition that site-specific under-estimates and over-estimates are not particularly important for broad-area valuation, planning and analysis purposes. That is, the best existing empirical information made up the basis for average unit value estimates.

Shortly after these estimates were made, the Water Resources Council issued new guidelines. Based on their (independent) review of travel cost and bidding game studies, they defined limits in which it would be acceptable for unit values to fall. All agency estimates fell well within or below these limits (Table 1).

Table 1.--Independent estimates of unit values of WL/F recreation by Forest Service and Water Resources Council

Activity	Forest Service	Water Resources Council[1/]
Hunting and fishing		
Big game	$10.50	
Waterfowl	8.00	
Upland birds	8.00	
Small game	8.00	$7.50 - 12.87
CW fishing	5.25	
WW fishing	5.25	
Non-consumptive uses	$7.25	$4.29 - 12.87

1/ These limits are appropriate for the wildlands-dependent recreation provided by NFS.

The Council noted that those activities that take place in the absence of developments should be assigned values at the high ends of their limits and explicitly stated such is the case for big game hunting, salmon and steelhead fishing, and nonconsumptive uses in remote areas. It happens that there are available empirical travel cost studies that indicate the average unit value for anadromous fishing is actually about $19.50, well above the Council limit.

Overall, a review of the agency average unit values, then, would appear to be quite conservative. In particular, the values ascribed to big game hunting and cold water fishing are probably significantly underestimated.

Possibility of introducing significant errors.--For possible misestimates of benefits to introduce significant errors into the planning and/or budgeting process, it must be true that analytical results used in those processes are sensitive to benefit estimates and/or that significant new errors are introduced. There is no empirical evidence available to determine whether either is true; because of the early stage of Forest planning, sensitivity analyses of the analytical (FORPLAN) model have not focused on estimates related to WL/F recreation valuation. However, there are logical reasons and indirect evidence for believing that any valuation errors are unlikely to influence results.

Consider the estimates that must be provided as the basis for the FORPLAN models:

1. Biological production functions. Estimates must be made of the change in physical condition due to a management prescription.

2. Choice of management prescriptions. Estimates must be made of allowable prescriptions and specific activities. That is, an implicit filtering by the interdisciplinary team is required.
3. Changes in physical conditions must be translated into changes in RVD's.
4. Average unit values per RVD must be estimated.
5. Explicit constraints on the solution space must be established to reflect RPA-mandated targets and protective standards and guidelines and as technical translations of public issues and management concerns.

Given all of these requirements for estimation, it is extremely unlikely that specified unit values would be as much in error as other model inputs. Indeed, preliminary reviews of budget data suggest the existence of much larger errors in estimates of biological and use functions than in average unit value estimates.

While it is unlikely that possible errors in unit value estimates are significant in themselves, the current valuation of WL/F management activities generating recreational opportunities in LMP may be introducing significant errors, that is, the multiplication of unit values by estimated RVD's sometimes yields erroneous answers. FORPLAN currently applies the average unit values to every opportunity that would result from applying the selected management prescriptions without regard to the probability of their utilization. The model does not contain a mechanism to discriminate between "marketable" and "unmarketable" opportunities for any resource outputs except commercial timber.[7/] As a consequence, the benefits of LMP alternatives are

---

7/ For timber, it is possible to specify the zero-quantity price-intercept and a (linear) demand curve slope; for all other resources, only average output unit values can be specified.

probably occasionally overstated and may lead to over-budgeting. Whether an inappropriate balance among resources results depends upon the relative quantities of different resources that might be produced and the commensurability of value estimates among resources.

As budgets are increasingly developed on the basis of Forest plans, which will be generally the case for support of the RPA-85 Program, any errors, as well as any improvements in data quality, inherent in the planning process will appear in the budget process. Integration of these processes will gradually lead to consistency and rule out the possibility of the introduction of new errors from separate functional planning activities.

Netting-out Loss of Benefits

It was noted earlier that the proper crediting of benefits to NFS WL/F management is dependent upon whether attention is focused on enhancing the welfare of the population serviced by a single Forest or on the nation's total population. In the latter case, gains in benefits in one area might have to be reduced by losses in realized benefits elsewhere. Current planning and budgeting procedures only count benefits and losses in benefits on NFS lands. Presumably, in determining the appropriate NFS share of all needs and opportunities, the RPA-85 Program (and, perhaps, future Regional plans) will address this issue.

Conceptual framework.--Conceptually, the correct procedure for netting out losses is straight-forward. If recreationists substitute recreation on a National Forest for recreation in the same quantity on a different ownership, the National Forest site rent would overstate the net benefit to society. The correct estimate would be the difference in site rent between that appropriate to the National Forest and that appropriate to the earlier area. Conventional economic assumptions lead to the conclusion that the National Forest site rent would be higher, that is, there would be a net national benefit.

Why? There are two possibilities. Possibly with no change of physical opportunities or incurred costs, recreationists might change locations. Such a change cannot be rationalized unless it is recognized the recreationists must have perceived that the value to them would be higher. That is, the (personally defined) consumers' surplus would be greater on the National Forest. Of course, if recreational opportunities were, in fact, enhanced, the increase would be even larger.

The second possibility is that actual costs incurred in continuing to participate at the former area rose, relative to the costs of use of the National Forest, leading to a smaller consumers' surplus at the original location. If the former location would still provide some surplus, the difference between site rents should be measured. If, however, recreationists are priced out of the market at the former area, that is no longer a viable option and the full site rent on the National Forest is the appropriate measure of benefit.

Significance of failure to net out benefits.--To determine the significance of not netting out benefits (that is, of always counting full site rent rather than sometimes counting differences in site rents) requires considering two questions: (1) how likely is it that (actual or perceived) enhanced opportunities in one portion of the nation will lead to reductions in use elsewhere? and (2) how likely is it that there will be net switching among ownerships in local situations?

In general, increases in WL/F-dependent recreation opportunities would not lead to shifts of recreational use among ownerships or sections of the nation if use of equivalent-quality opportunities is supply-constrained, all else being constant. Any increase in non-site use costs, such as those expected as a result of energy price increases, or general decreases in real disposable income make any shifts beyond very localized areas increasingly unlikely.[8/] In contrast, the increasing imposition of site-charges on private lands may lead to shifts to use of the National Forests.[9/]

8/ Some increases in general recreation and stocked-trout fishing in Forests on the Colorado front range are apparently at the expense of more remote Forests. Given increased crowding, increasing costs are apparently leading to acceptance of lower quality opportunities.

9/ Given the relatively high prices that can be charged for quality recreation in many instances (e.g. for duck hunting), it is doubtful that the increased NF site rent need be reduced to compensate for loss of private land site-rent.

Empirical data to support hypotheses that creation of NF opportunities will or will not lead to shifts of recreation from other ownerships is sparce. However, data supporting the 1975 National survey of hunting and fishing supports the notion that shifts across state or regional boundaries would be small at most:

Activity	% user-days out of State
Hunting	
Big game	
Deer	6%
Turkey	9%
Bear	14%
Antelope	65%
Elk	23%
Small game	3%
Migratory birds	4%
Fishing	
Coldwater, resident	12%
Warmwater	9%
Sea-run	15%

Less than 10 percent of hunting and fishing focused on widely distributed species occurs out of the home state of the recreationist. Given the relatively small size of the densely populated eastern states, it is reasonable to conclude that few recreationists are likely to travel very far in response to increases in quantity or quality of hunting and fishing opportunities. Therefore, netting out of claimed benefits is unlikely to be particularly important except among lands in different ownerships that are close together.[10/]

10/ While there is no known empirical evidence, family tradition, familiarity and simple habit probably also limit shifts; there is a "cost" to the user in responding to new possibilities.

Table 2 summarizes a variety of available national data concerning big game hunting. The National Forests provide the bulk of the hunting opportunities for bear, elk and moose in the United States, and in most sections are the only ownership that have the potential to substantially increase hunting opportunities. Given the supply-constrained nature of hunting these animals (as evidenced by special lotteries, sharply restricted bag limits and high out-of-state license fees), it is unlikely there would be any significant reduction in hunting on other lands in response to more hunting on the National Forests.

The argument is less clear in most parts of the country for widely distributed deer and turkey, but even in the eastern and plains states, the National Forests contribute a far larger share of opportunities than would be expected, based on their acreage. Particularly in the South Central and Great Plains states, where the trend is for decreases in all big game animals relative to the numbers of hunters, it is again unlikely that more hunting on one ownership implies less hunting elsewhere.

By and large, it is probably true that small game and upland game bird hunters are more likely to shift among ownerships in very localized situations, but few will shift if they must travel any great distance. In total, only 3 percent hunt outside their native state and, while they spend more days afield than big game hunters, the trips are short, costing less than one-third as much on average (Table 4.3, RPA-80 Assessment). With the exception of forest grouse, the National Forests supply relatively small portions of the hunting opportunities anywhere.

Table 2.--Proportion of big game hunting and sole-major potentials for increased hunting on the National Forests and expected trends (1975-1985) in available animals per hunter on all ownerships by RPA section.[1/]

Species sought	RPA Section						
	NE	NC	SE	SC	GP	RM	PC
	Percent						
Deer	5	15	30	20	5	40	40[2/]
Turkey	25	30	30	30	25	40[2/]	20
Bear	25	45[2/]	60	40	-	60[2/]	60[2/]
Antelope	-	-	-	-	10	10	-
Elk	-	-	-	-	-	80[2/]	60[2/]
Moose	-	-	-	-	-	70[2/]	-
NFS as proportion of total area	Percent						
	3	11	6	3	4	20	12
Expected trend in animals/hunter	+	+	0	-	-	0	0

1/ From Fig. 4.5 and Table 4.13 of RPA-80 assessment.

2/ NFS represents only ownership in section with major potential for expansion of animal population and hunting.

The National Forests are critical suppliers of coldwater fishing opportunities, and particularly of trout, steelhead and salmon. Any increase in these opportunities would probably be immediately absorbed with negligible impacts elsewhere. The currently unsatisfied demand, especially for salmon which must be shared among commercial and sport users, is enormous.

Overall, then, simply accepting increases in hypothetical site rents for hunting and fishing on the National Forests as a measure of net national benefit is unlikely to significantly overstate the case. The most likely exceptions are in the cases of small game and upland game bird hunting in the east and warmwater fishing, though the argument is still speculative.

There is no useful empirical evidence for arguing the case of nonconsumptive uses of wildlife and fish resources. With some notable exceptions, most such uses on the National Forests are incidental to other activities; their counting apart from general recreational activities is, for the most part, an artifact of the line item budgeting system. This is not to say that enhanced opportunities do not result from WL/F management, for they certainly do. The point is that the counting procedure that splits up integrated recreation "packages" into line item components introduces more uncertainty into assigning benefits to WL/F management than is inherent in concerns of whether failure to net out benefits introduces errors.

Summary and Conclusions

There are theoretically tenable empirical techniques for estimating the economic benefit to society of creating recreational opportunities on NFS through WL/F managment activities. However, because economic benefits provide only a partial measure of improvements in society's welfare, several different kinds of indicators--that cannot be reduced to a common numeraire--must be employed simultaneously.

The unit value estimates currently utilized by the Forest Service are unlikely to over-estimate recreation values. If they are in error, they are more likely to underestimate values, with possible exceptions being the estimated values of small game hunting and warmwater fishing in areas where alternative opportunities are abundant. In any event, it is quite unlikely that possible misestimates of unit values contribute to errors in either the planning or budgeting process. It is unlikely that the current state-of-the-art of travel cost and bidding game methodologies would lead to any substantial gain in correctness of estimation in the current, large area land management planning process.

Because no credit is taken for quality-related increases in value of recreation opportunities, benefits of WL/F management activities are underestimated. It does not appear likely, in general, that failures to adjust NFS benefits for losses in benefits elsewhere leads to substantial overestimates. There may be exceptions in specific circumstances.

The major problem at present is our inability to limit counting benefits in LMP to the quantity of opportunities that are likely to be actually utilized. This problem is serious enough to warrant a high priority for resolution. When such quantity estimates are available for use, they can be used with average unit value estimates as an alternative to equating marginal revenues to marginal costs in evaluating the RPA-85 Program.

APPENDIX: WL/F MANAGEMENT RATIONALIZATION

The setting of objectives that are consistent with society's welfare is basically a political process, as is evidenced by the requirement that "public issues" be defined in Forest land and resource management planning (LMP). The currect objectives of WL/F management may be categorized as those dealing with habitat conditions (e.g. adequate to maintain current diversity of species), faunal conditions (e.g. improve status of threatened and endangered species), and user conditions (e.g. supply a high level of good and services). Two universal criteria for evaluating possible activities are cost-effectiveness and secondary (indirect) impacts.

The general steps required to develop data basic to rationalizing WL/F activities are outlined in Table A-1. The general question to be answered is "what will change as a result of management?" When these steps have been completed--when both benefits and costs have been defined--it is possible to evaluate management activities, that is, to decide whether those activities are desirable.

Table A-1.--Process of estimation required to rationalize wildlife and fishery management activities in relationship to specified objectives.

It is necessary to estimate changes in	By measuring changes in
1. Costs	1. Budget expenditures
2. Conditions	2. Without-management situation
2.1. Habitat	2.1. Acres treated, carrying capacity
2.2. Fauna	2.2. Occurence, condition, population
2.3. User-related	2.3. Quantity of opportunities Quality of opportunities
3. Benefits	3. Conditions relative to objectives
3.1. Habitat	3.1. Achievement index
3.2 Fauna	3.2. Achievement index
3.3 User-related	3.3. Number of users Willingness-to-pay
3.4. Indirect	3.4. Social effects

Costs

The costs of management are defined by budget expenditures.[1/] Because the basic concern is that of enhancing the welfare of American society in total, all costs incurred by that society must be counted. Therefore, if NFS expenditures result in more hunting that must be accompanied by greater State expenditures for game wardens, the cost of providing more hunting is the sum of the NFS and State costs.[2/]

Conditions

Most wildlife and fish management objectives are expressed in the form of maintaining or enhancing habitat or faunal conditions. Such is true of the management targets defined in the RPA-80 Program, which were expressed in terms of "acre-equivalent" accomplishments and increases in relative carrying capacities. For activities intended to meet such objectives, it is necessary to define changes in the same terms as the objectives are stated--that is, in terms of acre-equivalents treated or increases in carrying capacity.

1/ Total costs include expenditures of land, labor and capital. While the last two types are reflected in budget expenditures, the precise definition and analytical treatment of land (or opportunity) costs is subject to debate. For present purposes, it is adequate to assume that this cost has been considered in the decision process that established WL/F management objectives and/or will be considered in comparing alternatives and deciding whether to fund a particular management proposal.

The opportunity cost of budget (tax) dollars is imbedded in minimum acceptable rate-of-return specifications. For NFS purposes, that specification is a 4 percent real rate-of-return.

2/ In practice, non-Forest Service costs are seldom included in economic efficiency evaluations of the production of any NFS resource. The significance of this deviation from conceptually correct practice is unknown.

To the extent that objectives might be stated in terms of use by humans, changes in the quantity of opportunities for use would always be required; changes in the quality of existing opportunities (i.e. human satisfactions) might also be relevant. In either event, both biological production functions that specify changes in conditions and use functions that specify levels of use must be estimated.

Benefits

Benefits specify the value of changes in society's welfare, whether they are positive or negative. The expressions of value must be in the same terms as the (explicit or implicit) expressions of objectives.

For WL/F activities proposed to meet biological or activity targets, some sort of constant ruler must be applied to provide before-treatment and after-treatment measures of conditions in the same units used to define the targeted objective: The difference is the benefit.

The same is partially true of user-related objectives; progress or benefit might be expressed simply as an increase in the number of users. However, something more can be done to measure benefits. Market transactions provide a direct means of valuing commercial WL/F products. Theoretical constructs provide a comparable if indirect means of valuing recreation. So long as the basis of valuation is willingness-to-pay, valuation is consistent within WL/F uses and between these uses and the uses of all other resources. As a result, such values define benefits that can be properly imputed to management activities for purposes of rationalization.

Regardless of the objective of activities, indirect benefits and disbenefits (collectively called social effects in Table A-1) must be estimated. Such effects have usually been measured in terms of employment, income and indicators of various dimensions of community welfare. As in the case of costs, the focus on society's welfare requires counting all "indirect" benefits, regardless of their incidence. Such counting is explicitly required in Forest planning under the rubric of impact and social analysis.

Evaluation

Given estimates of benefits and costs, it is possible to make the comparisons or evaluations required by the planning, budgeting and decision processes of the agency. Essentially, some measure of expected achievement must be compared with expected budget outlays; together with an idea of likely spin-off or indirect benefits, the basis is created for the decision process.

To the extent that the measure of achievement is expressed in the form of dollars or dollar-equivalents, a measure of efficiency of the use of scarce budget dollars can be generated. This has several advantages. (a) Since efficiency measures are independent of the specific purposes for which dollars are spent, they can be directly compared across all alternative uses of dollars. (b) These measures are suitable for use with the most powerful analytical tools that exist, those of economic analysis. For example, the value of timing of costs and benefits can be explicitly treated and summarized and a consistent approximation of a welfare function for society can be employed as a standard for judgement. (c) There are no problems in aggregating data for analysis at alternative hierarchal levels, either conceptually or in terms of existing agency data systems.

Unfortunately, the very existence of such analytical advantages (which can be totally relied upon for commodity resources) makes the rationalization of the WL/F management activities more difficult, for most WL/F objectives and benefits are not expressable in dollar or dollar-equivalent terms. Instead, they are directly derived from political concerns for physical conditions or social settings and are usually expressed as absolute requirements that are not amenable to efficiency analyses (except in the limited sense of cost-effectiveness).[3/]

Only when the measure of achievement is user-related can WL/F management benefits be expressed in economic terms but even then, because many activities simultaneously address separately defined non-use objectives of improving physical conditions, there is a danger of not fully crediting all benefits. That is, creating habitat conditions to support both more elk and more hunters may be undertaken, but only the economic values implicit in more hunters may be credited because we have no useful means of estimating option or existence values. Indeed, failure to undertake such activities may be disallowed in the political process for reasons that have little to do with hunting opportunities. (For clarity, substitute "Montana grizzly bears" for "elk"; note that both are hunted.)

3/ The actual FY 81 WL/F budget contains essentially the same allocation for activities not expected to (directly) yield dollar (commercial fish) or dollar-equivalent (recreation) values as the RPA-80 Program poposal initially approved by USDA but only one-half the allocation for activities yielding such values. Apparently, the political decision process compensates for analytical short-comings.